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NO DRAWINGS

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(54) POWDERED EMULSIONS

(71) We, ABBOTT LABORATORIES, a Corporation organized and existing under the laws of the State of Illinois, United States of America, of 14th Street and Sheridan Road, North Chicago, County of Lake, State of Illinois, United States of America, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to improved powdered fat emulsions. More particularly, this invention is directed to a novel powdered fat emulsion in that said composition may alternatively be 1) used as a coffee creamer; 2) reconstituted with water and whipped into a whipping topping; and 3) used as a substitute for milk in food recipes.

Powdered fat compositions are known in the art. These compositions are generally dry emulsions containing particles of fat material encased within a coating of some edible, water-soluble material such as protein or carbohydrate, and spray-dried or drum-dried to produce a dry powder. In this form, some of these compositions are useful as substitutes for cream in coffee or tea, while others have been developed for use in prepackaged cake or biscuit mixes to supply the necessary fat content of the mix; and still others are useful as whipped toppings for dessert and the like, when reconstituted with milk or water and whipped either by hand or by mechanical means. These compositions offer such advantages as, ease of handling, the capability of being incorporated with other free-flowing ingredients to prepare various food products, and simplification of cooking operations.

Generally, a powdered fat composition includes an edible fat or oil, proteinaceous material or a protein-carbohydrate mixture, a sweetener and an emulsifier, to produce an emulsion type product. The mixture is emulsified, pasteurized and homogenized and finally spray-dried or drum-dried to produce a free-flowing powdered composition. Other components such as stabilizers, flavorants, coloring agents and stiffening agents may be added for taste and aesthetic appeal. It is significant, however, that none of the compositions known in the art have a multi-purpose utility.

It is therefore an object of this invention to provide a powdered fat emulsion which has diverse utility in that the same composition may be 1) utilized as a coffee creamer substitute; 2) reconstituted with water and whipped into a whipped topping and 3) used as a substitute for milk in food recipes. In addition, this composition provides a whipped topping having a stabilization period of at least two days without refrigeration which is much greater than prior art compositions. Another object of this invention is to provide a composition having a lower caloric value per unit volume as compared with other known compositions. Finally, a powdered fat emulsion is provided which has increased stability in the presence of calcium ions.

An improved edible fat composition is described in U.S. Patent 3,098,748. This composition contains 40—65% of a bland edible oil, 5—15% of a protein, 5—35% of a sweetener and 1—15% of a whipping agent as basic ingredients. Other ingredients which may optionally be added include emulsifiers such as lecithin, stabilizers such as sodium alginate, and stiffening, coloring and flavoring agents. The various compositions described therein, however, have utility only as whippable toppings. Neither these compositions nor other compositions known in the art are composed in such a manner as to have more than a single-purpose utility as previously mentioned.

It has been found that by controlling the nature, and the particular combination, of the various ingredients, as well as the physical characteristics of the composition, it is possible to develop a single powdered fat emulsion which may successfully be utilized in a wide variety of uses.

Generally, the compositions of this invention include an edible oil, an emulsifier, a sweetener and a protein combined in a specified range of amounts. These ingredients are combined in an aqueous emulsion and pressure atomized to form a free-flowing

powder. In forming this composition, the protcinaceous material is first dispersed in water. The sweetening agent is then added to the protein-water mix and the whole mixture is heated and stirred until all components are dissolved. A buffering agent is added such that the pH of the mix is adjusted to between 5.0 and 9.0, and a coloring agent optionally added. In a separate vessel, all of the fat components are melted together and mixed until the mixture is uniform. Both the fat and the water phase are then homogenized under a pressure of between 300—3500 psi. The resulting emulsion is atomized under pressure to produce a powder. The powder is cooled so as to crystallize the fat and placed in a vessel wherein the powder is blended with a flow agent to remove excess moisture and promote flowability. The powder is then in condition for packaging or use.

In selecting the oil or fat component for this composition, several different oils or a combination of oils may be used so long as certain requirements are met. Any oil, fat or fatty-like substance having the appropriate fat-solids index may be successfully utilized. The fat-solids index, hereinafter referred to as F.S.I., is that profile of a fat or oil which shows what percentage of the substance is in the solid state at a given temperature. The F.S.I. requirement for the oil phase of this invention may be characterized as shown in the following table.

TABLE I

°F	% Solids
50	68±3
70	50±3
80	35±3
90	18±2
100	11±2
110	4±2

Any oil or fat, or combination of oil or fat which yields this F.S.I. index is suitable for my novel composition. The edible fat component constitutes from about 20% to about 40% by weight of the finished product, the preferred range being between 25 and 35% based upon weight of the dry product. The fat system of the composition must be accurately controlled inasmuch as too much fat makes for a greasy taste in coffee while too little fat reduces the whippability. Generally, there are many suitable oils which may be utilized in the composition of this invention including: Palm kernel oil, Coconut oil, Cottonseed oil, Quri-Curi oil, Cohune oil, Tucum oil and Ucuhuba oil. In the preferred embodiment, a combination of Palm kernel oil and Coconut oil yields a suitable powdered fat emulsion.

The emulsifier may be any vegetable or animal fat emulsifier having 50—100% mono and di-glycerides. It has been found that the best emulsifier has a greater percentage of monoglycerides since these are more reactive than di-glycerides and therefore perform more efficiently as emulsifiers. The best performing emulsifier is glycerol lacto-monopalmitate since it is lactated and nearly 100% mono-glyceride. Other emulsifiers may be employed either alone or in combination, and these include, propylene, glycol monostearate, glycerol lacto-oleate, sorbitant monostearate, and polyoxyethylene sorbitan monostearate. The glycerol lacto-monopalmitate may be added in amount of from 1% to about 6% based upon weight of the dry product, the preferred range being about 1% to about 3.5%. The ratio of glycerol lacto-monopalmitate to vegetable oil has a critical range of 0.040:1 to about 0.100:1. In the preferred embodiment, the ratio of glycerol lacto-monopalmitate to vegetable oil is about 0.060:1. Propylene glycol monostearate or glycerol lacto-oleate may be used in a range of from about 3% to about 9% based upon weight of the dry product. If sorbitant monostearate is utilized, it must be combined with another emulsifier to achieve proper whippability. An example of this combination would be about 3% about 8% of the sorbitan monostearate with from about 0.3% to about 1.0% of the polyoxyethylene sorbitan monostearate.

The sweetening agent may be any carbohydrate whether it is suger, an acid hydrolyzed or enzymatically hydrolyzed starch, or a cellulose, so long as the material satisfies the swectness and water-solubility-dispersability requirements for this composition. As used herein, the term "carbohydrate" signifies any carbohydrate material which acts as a bulking or filling agent and/or sweetener, either alone or with other sweeteners. Generally, corn syrup solids are used as the sweetening component of the instant composition. Corn syrup solids contain a combination of dextrose, maltose and dextrins with the water removed. Quantitatively, from about 55% to about 70% of the corn syrup solids are utilized in this novel composition based upon weight of the finished product. Of course, other sweetening agents may be substituted or used in combination with corn syrup solids. For example, monosaccharides or disaccharides, such as lactose, may be substituted for a portion of the corn syrup solids. Corn syrup (30% water by weight) may be used where larger batches of the composition are to be made. In any event, the sweetening agent should remain within the range of from about 55% to about 70% based upon weight of the dry product regardless of whether it is a single component or a combination of sweetening components.

An important feature of this invention, from the stand-point of health, is that the finished product contains less calories per unit volume than other such compositions

previously known. This is accomplished by changing the fat-sugar ratio such that more sugar and less fat is utilized. Since fat contains approximately 9 calories per gram and sugar contains 4 calories per gram, by employing a greater percentage of sugar and a lesser percentage of fat, without at the same time destroying the performance of the composition in any of its diverse functions, the caloric value has been successfully reduced. Of course, the caloric value per unit volume of the whipped composition is dependent upon the percent overrun in the whipped material. Using the average overrun, however, there are approximately 13 calories in one tablespoon of the composition in whipped form.

The control of pH is also a necessary step in formulating the composition of this invention. The pH for this composition must be maintained within a range of from about 5.0 to about 9.0. If the pH is allowed to become too acid, there is a tendency for the caseinate to coagulate, whereas if the pH becomes too alkaline, the product develops a soapy taste. Although the pH range of from about 5.0 to about 9.0 may be successfully employed, it is preferred to use a pH of from about 6.0 to about 8.0. In order to adjust and maintain the pH in the preferred range, stabilizers are added to the composition. Stabilizers, as referred to above, are synonymous with buffering agents. Any food approved buffering agent may be used which will maintain the pH in the specified range. Generally, these include sodium tripolyphosphate, sodium pyrophosphate, tetra sodium pyrophosphate and di-potassium phosphate. Preferably, di-potassium phosphate is utilized in an amount equaling from about 1% to about 4% of the composition based upon weight of the dry product. Of course, a combination of buffering agents may be employed. For example, some other buffering agent may be combined with di-potassium phosphate to maintain the proper pH level. The particular buffering agent or combination of such agents is not critical to the success of the composition so long as the proper pH level is maintained.

In connection with pH control, it is important to avoid shifting the pH out of the desired range when adding optional components. For example, flavorants and coloring agents may alter the pH and in such an event, additional amounts of the buffering agent must be incorporated into the composition to maintain the pH within the desired range.

Another necessary component of this composition is the proteinaceous material. Although the role of this material is not precisely understood, it is known that it is a necessary component for forming a stable oil-in-water emulsion. The present theory is that the protein performs an encapsulating function on the fat by orienting on the membrane of the fat globule. In this manner, the fat may be initially dispersed in water without the tendency to form globules. The subsequent addition of the emulsifying agent fixes the fat in a stable oil-in-water emulsion. In the preferred embodiment of this invention, sodium caseinate is utilized although other protein material may be used. For example, skim milk solids consisting of a combination of lactoglobulin, lactoalbumin and casein, may be used as a substitute for the caseinate. Generally, the caseinate comprises between about 3% to about 6% of the composition based upon the weight of the dry product. A more precise measurement of the percentage of caseinate to be added is to measure the ratio of the caseinate to the vegetable oil. In the preferred embodiment, the ratio of caseinate to oil should be in the range of from 0.110 to 0.333, with the ideal ratio having a value of 0.162.

In order to further stabilize the composition, a flow agent is added to the powdered composition after it has been removed from the atomizer. Usually, the flow agent consists of a desiccant to remove excess moisture and impart flowability to the mixture. However, flow agents may also include dry lubricants and agents which will reduce the static charges on the particles. In the preferred embodiment of this invention, the flow agent consists of a desiccant which is blended in with the powder in order to absorb excess humidity from the powder. This, in turn, prevents the fat particles from coalescing or caking on exposure to a humid environment. Any desiccating agent approved for food use may be employed in an amount of from about 0.01% to about 0.06% based upon weight of the dry powder. Examples of suitable desiccants include silica aerogel, activated alumina and sodium silico-aluminate. Good results are obtained and it is preferred to use sodium silico-aluminate in an amount of about 0.03% based upon weight of the dry powder.

Other optional components may be added if desired. For example, coloring and flavoring agents may be added for taste and aesthetic appeal. Any food approved coloring agent may be utilized. Coal tar derivatives, such as Bankivis yellow color, and carotenoids, such as beta-carotene, may be successfully used in amounts of from about 0.01% to about 0.10%. It is preferred to use a coloring agent which imparts a buttery color to the composition and therefore Bankivis yellow color is preferred in an amount of up to about 0.10% based upon weight of the dry powder.

Any flavorant which is approved for food use and yields the desired result may be used. The only limitation for this component is that it does not effect a change in pH to shift same out of the range of about 5.0 to about

9.0. In the preferred embodiment, lipolyzed butter oil is employed in the range of from about 0.1% to about 1.0% based upon the weight of the dry product.

Other components may optionally be included or substituted for those mentioned. For example, from about 0.5% to about 4.0% sucrose may be added to the corn syrup solids for additional sweetening. Also, flavor enhancers, such as cyclamic acid, may be employed in amounts ranging from about 1% to about 10% of the flavorant utilized.

The nature of the novel compositions and processes will be better understood by reference to the following examples which are given to illustrate but not limit the invention.

EXAMPLE 1

The following example describes a process for making a 50 pound batch of a novel composition.

A. A mixture of 31.5 pounds of corn syrup solids, 2.5 pounds of sodium caseinate, one pound of di-potassium phosphate and 0.01 pounds of Bankivis yellow color is dry blended. The dry mix is then dispersed in about 50 pounds of water and heated to a temperature of 150°F.

B. In a separate operation, 6.18 pounds of coconut oil, 7.83 pounds of palm kernel oil, .90 pounds of glycerol lacto monopalmitate and 0.15 pounds of lipolyzed butter oil is melted together in a stainless steel steam jacketed process vessel and heated to a temperature of 150°F. The mixture is maintained at 150°F for about 10 minutes while being thoroughly agitated to insure a homogenous mixture.

The water mix from Part A is pumped into a two stage homogenizer where the pressure is 1500 psi/500 psi. Simultaneously, the oil mix from Part B is also pumped into the homogenizer, being metered at such a rate as to correspond to the rate at which the water mix is pumped so that both mixes are completely pumped in at the same time. The mixture is homogenized yielding an oil-in-water emulsion, which is then fed into a box dryer whose outlet temperature is 180°F. The resulting emulsion is then pressure atomized at 4500 psi in a spray dryer.

The dried product is conveyed to a powder cooler where the fat in the product is crystallized by cooling coils containing water maintained at a temperature of 40°F. To this powder is added 0.015 pounds of sodium silico-aluminate in a barrel blender and the mix is blended for 30 minutes. The resulting finished product is then ready for packaging or use as desired.

EXAMPLE 2

The following example describes the process wherein a 10,000 pound batch of the powdered fat composition is manufactured.

A. To a large capacity tank is added 9000 pounds of corn syrup (30% water by weight) and the temperature is brought to 145°—150°F.

B. In another tank, a 10% weight solution of sodium caseinate in water is prepared by adding 500 pounds of caseinate to 4500 pounds of water. To this is added 2.0 pounds of Bankivis yellow color, and the mix is then brought to a temperature of 145°—150°F.

C. In a third tank, a 20% weight solution of di-potassium phosphate in water is prepared by adding 200 pounds of the phosphate to 800 pounds of water, and this mix is brought to a temperature of 120°F.

D. In still a fourth tank, 1235 pounds of coconut oil is added with 1565 pounds of palm kernel oil, 180 pounds of glycerol lactomonopalmitate and 30 pounds of lipolyzed butter oil. The oil mix is brought to 150°R and the oils are mixed well.

E. The corn syrup mix of Part A and the caseinate mix of Part B are pumped into a common tank at the rate of 9.0 pounds of the A mix to every 5 pounds of the B mix. These are thoroughly mixed together and run through a cooler to bring the temperature down to about 60°F.

F. This mix is then pumped into a still-cooler tank where it is combined with the mix prepared in Part C in a ratio of 1.0 pound of C mix to every 14.0 pounds of E mix. The temperature is brought down to about 40°F in this tank.

G. The mix from Part F is pumped through a plate heater maintained at a temperature of 175°F into a two stage homogenizer. Simultaneously, the mix from Part D is also pumped into a homogenizer at the rate of 15.0 pounds of the F mix to every 30 pounds of the D mix. This mixture is homogenized at a pressure of 1500 psi/500 psi and is then pumped to a tower drier under a pressure of 4000—4500 psi.

H. The dried powder falls into a cooler where the fat is crystallized by cooling coils containing water maintained at 40°F.

I. The cooled powder is placed in a tote bin blender and mixed with sifted sodium silico-aluminate in a ratio of 300 pounds of powder to every 0.09 pounds of the silico-aluminate. This mixture is blended for 30

minutes yielding the finished product which is ready for packaging or use as desired.

EXAMPLE 3

In a large capacity tank, a 10% by weight solution of sodium caseinate is prepared as described in Part B, Example 2. In another tank, a mix is prepared as described in Part D, Example 2, except that only 10% of the total coconut oil to be added is included with the glycerol lacto monopalitate and the lipolyzed butter oil. The caseinate mix and the oil mix are then homogenized together at a pressure of 1500 psi. The resulting mixture then meets with the corn syrup mix as described in Part A, Example 2, and the two are pumped into a cooled (40°F) alcng with the di-potassium phosphate mix (Part C, Example 2). The resulting mix is then processed as described in Parts G, H and I of Example 2, resulting in the finished product.

EXAMPLE 4

Whipped Topping

To one-quarter cup of water is added 1-1/4 tablespoons of sifted powdered sugar and two-thirds cup of powdered composition. The mixture is whipped with a standard electric mixer for about 2 to 4 minutes. The resulting whip has a smooth consistency, and is ideally suited as an edible whipped topping for desserts and the like. The whip prepared according to this example retains its superior qualities even after 2 days of standing without refrigeration.

EXAMPLE 5

Oatmeal Preparation

In a saucepan, 1 cup of oats, 1/2 teaspoon of salt, and 1/2 cup of the composition as prepared in Example 1 is added together. To this mixture is added 2 cups of boiling water and the mixture is stirred until blended. The mixture is then heated to a boil, stirred constantly and cooked for about one minute. The resulting preparation is then removed from the heat and allowed to cool for a few minutes.

The resulting oatmeal preparation is edibly satisfying and in all ways conforms to the taste requirements of such a food product.

As a coffee creamer substitute, one teaspoon of the powdered composition when added to coffee produces an edibly acceptable emulsion. Furthermore, the coffee emulsion is stable in the presence of calcium ions and therefore the calcium salts of artificial sweeteners may be utilized in this coffee emulsion.

We are aware of the Colouring Matter in Food Regulations 1966, and in so far as our invention relates to the manufacture for sale, and/or sale in the United Kingdom, of foodstuffs coloured as herein described, we make no claim to the use of the invention in contravention of the Regulations. We are also aware of the Artificial Sweeteners in Food Regulations 1969 and likewise make no claim to the use of the invention in contravention of these Regulations.

WHAT WE CLAIM IS:—

1. A dry powdered fat emulsion composition comprising from 20% to 40% edible fat, from 55% to 70% of a sweetener, from 3% to 6% protein, from 1% to 9% of an emulsifier, from 1% to 4% of a buffer, and from 0.01% to 0.06% of a desiccating agent all amounts being based upon weight of the finished product.

2. A composition according to Claim 1 wherein the edible fat component is a vegetable oil or a combination of at least two vegetable oils, said oils having a fat-solid index within the range of $68\pm3\%$ solids at a temperature of 50°F and $4\pm2\%$ solids at a temperature of 110°F.

3. A composition according to Claim 1 or 2, wherein the sweetener is selected from the group consisting of monosaccharides, disaccharides and a combination of monosaccharides and disaccharides.

4. A composition according to any preceding Claim, wherein the protein component is a member selected from the group consisting of sodium caseinate and skim milk solids.

5. A composition according to any preceding Claim, wherein the emulsifier comprises a fat emulsifier having a combination of between 50% and 100% monoglycerides and diglycerides.

6. A composition according to any preceding Claim, wherein the buffer comprises a food approved buffer capable of maintaining the pH of said composition within the range of 5.0 to 9.0.

7. A composition according to any preceding Claim, wherein the desiccating agent is silica aerogel, activated alumina or sodium silico-aluminate.

8. A composition according to any preceding Claim, wherein the edible fat component is cottonseed oil, palm kernel oil, coconut oil or a combination of said oils.

9. A composition according to any preceding Claim, wherein the edible fat component comprises a combination of palm kernel oil and coconut oil.

10. A composition according to any preceding Claim, wherein the sweetener comprises corn syrup, corn syrup solids, sucrose, lactose or a combination of same.

11. A composition according to any preceding Claim, wherein the protein component consists of sodium caseinate.

12. A composition according to any preceding Claim, wherein the emulsifier comprises glycerol lacto-monopalmitate, glycerol lacto-oleate, propylene glycol monostearate,

sorbitan monostearate, polyoxyethylene sorbitan monostearate or a combination thereof.

13. A composition according to any preceding Claim, wherein the emulsifier consists of glycerol lacto-monopalmitate.

14. A composition according to any preceding Claim, wherein the buffer comprises sodium tri - polyphosphate, sodium pyrophosphate, tetra sodium pyrophosphate or di-potassium phosphate.

15. A composition according to any preceding Claim, wherein the buffer consists of di-potassium phosphate.

16. A composition according to any preceding Claim, wherein the desiccating agent consists of sodium silico-aluminate.

17. A dry powdered fat emulsion composition comprising from 20% to 40% of an edible fat selected from the group consisting of a single vegetable oil and a combination of at least two vegetable oils, said oils having a fat-solid index within the range of $68 \pm 3\%$ solids at a temperature of 50°F and $4 \pm 2\%$ solids at a temperature of 110°F; from 55% to 70% of a sweetener selected from the group consisting of monosaccharides, disaccharides and a combination of monosaccharides and disaccharides; from 3% to 6% protein material selected from the group consisting of sodium caseinate and skim milk solids; from 1% to 9% of an emulsifier having a combination of between 50% and 100% monoglycerides and diglycerides; from 1% to 4% of a buffer selected from the group consisting of tripolyphosphate, sodium pyrophosphate, tetra sodium pyrophosphate and di - potassium phosphate; and from 0.01% to 0.06% of a desiccating agent selected from the group consisting of silica aerogel, activated alumina and sodium silico-aluminate; all amounts being based upon the weight of the finished product.

18. A composition according to Claim 17 including from 0.01% to 0.10% of a food approved coloring agent; from 0.1% to 1.0% of a food approved flavoring agent; and a flavor enhancer in an amount of from 1% to 10% of the amount of flavoring agent added.

19. A composition according to Claim 18 wherein the coloring agent is a member selected from the group consisting of coal tar derivatives and carotenes.

20. A composition according to Claim 18, wherein the coloring agent consists of Bankivis yellow color, the flavoring agent consists of lipolyzed butter oil and the flavor enhancer consists of cyclamic acid.

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